IOWA DEPARTMENT OF NATURAL RESOURCES
Flood Plain Management Program

Pedestrian Bridge Analysis Guide

Application: Completed and signed application form submitted? Yes____ No____
(A copy can be obtained at http://www.iowadnr.com/water/floodplain/index.html)

Applicant Name: _____
Location: ____ Sec ____, T____N, R_____, County: _____
Located within corporate limits? Yes____ No____
Stream: _____
Drainage Area: _____

When a Flood Plain Permit is required: Approval thresholds for pedestrian bridges are identical to highway bridge thresholds as outlined below.

567—71.1 (455B) Bridges, culverts, temporary stream crossings, and road embankments. *Approval by the department for the construction, operation, and maintenance of bridges, culverts, temporary stream crossings, and road embankments shall be required in the following instances.*

71.1(1) *Rural area—floodway. In rural areas, bridges, culverts, road embankments, and temporary stream crossings in or on the floodway of any river or stream draining more than 100 square miles. (NOTE: Channel modifications associated with bridge, culvert or roadway projects may need approval; see 567—71.2(455B).)*

71.1(2) *Rural area—floodway and flood plain. Road embankments located in the floodway or flood plains, but not crossing the channel of a river or stream draining more than 10 square miles, where such works occupy more than 3 percent of the cross-sectional area of the channel at bankfull stage or where such works obstruct more than 15 percent of the total cross-sectional area of the flood plain at any stage. In determining a 15 percent occupancy of the flood plain, the concept of equal and opposite conveyance as defined in 567—Chapter 70 shall apply.*

71.1(3) *Urban areas. In urban areas, bridges, culverts, road embankments and temporary stream crossings in or on the floodway or flood plains of any river or stream draining more than 2 square miles.*

Criteria for Standard Bridge Design: The backwater and freeboard criteria for standard bridges are as follows.

567—72.1(455B) Bridges and road embankments. *The following criteria shall apply to the construction, operation, and maintenance of bridges and road embankments.*

72.1(1) *Bridges and road embankments affecting low damage potential areas. For bridges and road embankments affecting floodway or flood plain areas having a low flood damage potential, the following criteria will apply:*

a. Backwater Q50. The maximum allowable backwater for Q50 and lesser floods is limited to 0.75 foot.

b. Backwater Q100. The maximum allowable backwater for Q100 is limited to 1.5 feet.

c. Freeboard. The minimum freeboard for low superstructure horizontal bridge members above Q50 is 3 feet.

72.1(2) *Bridges and road embankments affecting moderate damage potential areas. For bridges and road embankments affecting floodway or flood plain areas occupied by buildings or building complexes having a moderate flood damage potential, the following criteria will apply:*

a. The maximum allowable backwater for Q100 is limited to 1.0 foot.

b. The criteria specified in 72.1(1)"a" and "c."

72.1(3) *Bridges and road embankments affecting high or maximum damage potential development. For bridges and road embankments affecting floodway or flood plain areas occupied by buildings or building complexes having a high or maximum flood damage potential, the following criteria will apply:*

a. Backwater effects are to be minimized for all stages which affect maximum or high flood damage potential buildings or building complexes or for all stages which would tend to reduce the level of protection of certain flood control works, unless acceptable remedial measures are provided or such buildings are removed or the uses relating to human occupancy are prohibited.

b. In no case shall the criteria specified in 72.1(1)"a" and "c" and 72.1(2)"a" be exceeded.

72.1(4) *Bridge and channel change. For bridges and culverts involving channel changes on the floodway of any stream draining at the location of the channel change between 10 and 100 square miles whereby either (i) more than a 500-foot length of the existing channel is being altered or (ii) the length of existing channel being altered is reduced by more than 25 percent, the maximum allowable backwater shall correspond to the limits permitted in 72.1(1), 72.1(2), 72.1(3) or 72.1(5) depending upon the associated damage potential.*

Design Approaches: The design of a pedestrian bridge can be approached in 2 different ways:

Standard Bridge Design: One option is to approach the design as if it were a normal road bridge with elevated approach grades. The design would need to meet applicable department criteria with respect to backwater and freeboard as outlined in 567-72.3, Iowa Administrative Code (listed above).

When using this standard bridge design option, the review procedure outlined in the DNR's Bridge Analysis Guide should be followed.

Alternate Design: An alternate design option which works well on small streams involves keeping the pedestrian trail and bridge approaches on-grade and spanning the stream channel from bank to bank. If designed with low profile girders and minimally obstructing railings, these bridges will generally create negligible obstruction to flood flows. Approach grades for these types of bridges must be minimized so as to result in little or no obstruction of overbank flow. Often times, hydraulic modeling of these bridges will not be required. However, on streams where FEMA has published a detailed Flood Insurance Study (FIS), it will be necessary to provide the hydraulic modeling needed to certify that the bridge will result in "no rise" in the 100-year flood profile.

These low bridges typically do not meet department freeboard criterion and therefore, will require a variance to that criterion. As part of the freeboard variance justification, it may be necessary to submit a certification that the bridge can withstand the buoyant and hydrodynamic forces associated with the 100-year flood.

When opting for this alternate bridge design, it is recommended that a concept design be submitted to assure that this alternate design is applicable for the site.

Design plans for this alternate design should include: a to-scale site plan showing the stream, trail, bridge and other pertinent physical features; a cross-section of the stream along the centerline of the bridge showing the abutments, girder profile and bridge railings; and a trail profile, including natural ground where it is located on the flood plain.